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The prevalence rate of anterior cruciate ligaments reconstruction among population in Saudi Arabia

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ABSTRACT

Background: Anterior cruciate ligament (ACL) is an essential knee joint stabilizer that keeps the knee joint. Our research aimed to determine the prevalence rate of ACL reconstruction among athletic individuals living in Saudi Arabia. *Methodology:* A cross sectional design was conducted in Saudi Arabia. Athlete participants from Saudi Arabia took part in the ACL reconstruction study and the sample size for a population survey was derived using the "Raosoft" subject size calculator. The data analysis was performed using version 26 of IBM SPSS. *Results:* There were 898 respondents in the investigations and 85 of them (or 9.5%) had a history of ACL. 81.2 percent of patients said that a sporting-related incident led to their injury. 41.2% had a full tear, whereas 47.1% had a partial tear. In 45.9% of patients, there were 6 months or more between the ACL damage and repair, whereas this period was longer in 32.9% of patients. The time between ACL reconstruction and activity resume was 6–8 months in 48.2% of cases and 8–10 months in 28% of cases. Just 50.6% of patients resumed their previous level of physical activity. *Conclusion:* Saudi athletes get ACL injuries at prevalence rate similar to the world range. A large majority of the injured athletes had surgical repair, primarily in Saudi Arabia. The majority of the injured participants reported going back to sports after recovering.

Keywords: Anterior cruciate ligament, Reconstruction, Individual athletes, Saudi Arabia

1. INTRODUCTION

The anterior-cruciate-ligament (ACL) is a critical stabilizer of the knee joint that maintains antero-posterior and rotational stability of the knee joint mainly by passively restraining the movement of the tibia anteriorly as well as constraining the varus and valgus of the knee joint (Yang et al., 2022). Due

to the importance of ACL in important stabilizing element in the knee, rupture of the ACL reduces the stability of the knee, causing significant impact on athletic performance while also raising the likelihood of subsequent meniscal damage and early degenerative conditions (Al-Shareef et al., 2018). A non-contact mechanism while cutting, pivoting and leaping with the knee slightly flexed and, in a valgus, position is the most common manner of injury (Diermeier et al., 2020).

It is one of the most frequent sports injuries among active young individuals representing around 50% of all knee ligament injuries with ACL damage being one of the most common conditions that orthopedic surgeons see. An estimated 250,000 new ACL injuries occur each year and over 100,000 ACL reconstruction (ACLR) surgeries, the gold standard treatment, are performed in the US yearly while in France, 29,400 ACLR procedures were conducted in 2006 and more than 41,937 in 2013 (Al-Shareef et al., 2018). Between 2008 and 2016, an epidemiological study was conducted in Korea to estimate the anterior-cruciate-ligament reconstruction trends. During the period, there was a noticeable increase of ACLR procedures from 10,248 in 2008 to 14,500 in 2016. Moreover, the ACLR incidence rate per 100,000 person-years was significantly jumped from 21.8 in 2008 to 29.1 in 2016. Over this 9-year period, the number of cases and incidence between males for each 100,000 person-year were markedly increased from 8,543 to 11,534 cases (Chung et al., 2022). ACL injuries in National Football League (NFL) seasons from 2015 through 2019 ranged in number from 53 to 68, with an average of 62 injuries per season. The likelihood that an NFL player may suffer an ACL injury was estimated to be 1.9% every season (Palmieri-Smith et al., 2021).

ACLR is a worldwide technique with success rates ranging from 83% to 95% (Hussin et al., 2018). In the past, individuals with ACL insufficiency older than 40 years old had non-operative therapy with favorable results; however, it has been demonstrated that operative treatment is beneficial in active young patients for restoring knee stability and reducing the progression of cartilage damage breakdown when compared to non-operative treatment (Weng et al., 2022). In Jazan City of Saudi Arabia, a cross sectional study was conducted on 884 students, the average percentage of knee injuries was 18%. The results of the study demonstrated that men had a higher likelihood to experience knee injuries than women by 2.7 times and that high body mass index (BMI) were related to an increased number of knee injuries (Moafa et al., 2022).

With the seeming increase of ACL injuries in other countries and with the lack of information and research done about these injuries and their reconstruction in Saudi Arabia, it is necessary to determine whether this country has a similar problem as these other countries to better understand the presence of this issue. So, we will conduct this study to determine whether or not the prevalence of Anterior-Cruciate Ligament-reconstruction has been increased in athletic individuals living in Saudi Arabia. The purpose of our study to determine whether, prevalence of Anterior-Cruciate Ligament-reconstruction has been increased or not in athletic individuals living in Saudi Arabia.

2. MATERIALS AND METHODS

Study design

A cross sectional paper was conducted between July 2022 until March 2023.

Study setting

Participants, recruitment and sampling procedure

Individual athletes in Saudi Arabia participated in ACL reconstruction study and the calculation methodology of sample size for population survey was used "Raosoft", sample size calculator. According to these methods a minimum of 384 participants was needed; given that the margin of error alpha (α) =0.01, the confidence level = 99% and the response of distribution = 50%.

The Sample size was estimated using the formula: n= P (1-P) * $Z\alpha^2$ / d^2 with a confidence level of 95%;

n: Calculated sample size

Z: The z-value for the selected level of confidence (1- a) = 1.96.

P: An estimated prevalence of knowledge

Q: (1 – 0.50) = 50%, i.e., 0.50

D: The maximum acceptable error = 0.01.

So, the calculated minimum sample size was:

$n = (1.96)^2 \times 0.50 \times 0.50 / (0.05)^2 = 666$.

Inclusion and Exclusion criteria

In this study, we collected a group of people and identified in the group some required characteristics and some undesirable characteristics and the number of required characteristics that must apply to the group are four, the first characteristic is that the

person is over fourteen years old, that he or she is Saudi nationals. He or she is an athlete and exercises and he or she has previously performed an anterior cruciate ligament reconstruction procedure. In addition, we have applied conditions and characteristics that are required not to be in the group, which are as follows, that they are not less than fourteen years of age and that they are not non-Saudis. In addition to not being a person who is not an athlete and does not practice sports and finally if he has never had an anterior cruciate ligament reconstruction procedure.

Method for data collection and instrument (Data collection Technique and tools)

This study was performed in Saudi Arabia. After obtaining the approval of the ethical committee, an expert committee will review the intended text to be translated from its original language, identify cultural differences and similarities and assess the feasibility of the process. Translation will follow the guidelines of the principles of good practice in the translation and cultural adaptation of patient-reported outcome measures, as set out by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) 15 and permission was obtained from the original author of the scale. A forward translation was made by two individuals, one medical doctor with 15 years of experience and the second translator, an orthopedic resident who is naive to the questionnaire, to produce two independent translations. Both translations (F1 and F2) were reviewed by the expert committee and any discrepancies was discussed and resolved, and a report was issued. Back translation was performed by two individuals who speak English as their first language and are unfamiliar with the questions, producing two back translations (B1 and B2). The expert committee will review the reports issued in both forward and backward translations, reach a consensus on discrepancies and produce a pre-final version that was pretested on 50 patients in the outpatient department. Interviews of patients responding to the questionnaire regarding comprehension, confusing questions and potentially problematic sections the expert committee addressed these potential issues. All three reports were reviewed by the expert committee and a final version was created.

Analysis and entry method

Microsoft Excel 2020 is the program used for data entry. The data analysis was performed using version 26 of IBM SPSS. In describing the research, continuous variables such as central tendency and standard deviation were calculated. On the other hand, numbers and percentages are the methods used for categorical variables. Independent T-tests and Chi-square tests are used for the evaluation of bivariate variables. It is considered significant when the p-value is less than 0.05.

3. RESULTS

The study included 898 participants, 51.6% of them were males and 48.4% were females. 59.4% of participants aged between 20-30 years old and 13.9% were less than 20 years old. 96.9% were Saudi. 43.2% of participants were in normal weight range and 26.8% were overweight. 65.5% were single and 67.3% had bachelor degree.

Table 1 Socio-demographic characteristics of participants (n=898)

Parameter		No.	%
Gender	Male	463	51.6
	Female	435	48.4
Age	Less than 20	125	13.9
	20- 30	533	59.4
	31- 40	91	10.1
	41 – 50	92	10.2
	51 – 60	44	4.9
	More than 60	13	1.4
Nationality	Saudi	870	96.9
	Non-Saudi	28	3.1
Residence region	Central Region	78	8.7
	Eastern Region	290	32.3
	Northern Region	321	35.7
	Southern Region	86	9.6
	Western Region	123	13.7

BMI	Under weight	90	10.0
	Healthy weight	388	43.2
	Over weight	241	26.8
	Obese	179	19.9
Education level	Uneducated	3	.3
	Primary School	1	.1
	Secondary School	13	1.4
	High School	172	19.2
	Bachelor Degree	604	67.3
	Diploma	61	6.8
	Post graduated	44	4.9
Marital Status	Single	589	65.6
	Married	284	31.6
	Separated	15	1.7
	Widow	10	1.1
Employment	Not Employed	105	11.7
	Health Related Job	108	12.0
	Not Health Related Job	255	28.4
	Student	430	47.9

As in Figure 1, 91% of participants did not have Previous injury of anterior cruciate ligament and 9% of participants was had Previous injury of anterior cruciate ligament.

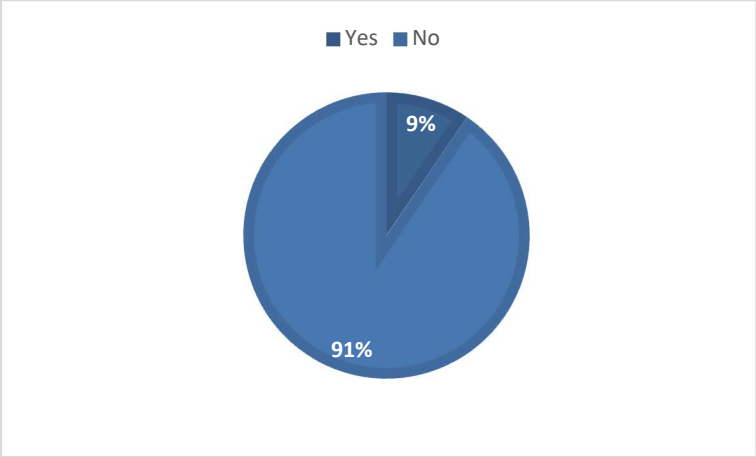

Figure 1 Occurrence of ACL among study participants (n=898)

Of all study participants, 40.4% had exercise regularly. 85 participants out of 898 (9.5%) had previous history of ACL. Regarding activity level among participants with history of ACL, 45.9% of participants sport sometimes, 27.1% frequently sport and 15.3% were highly competitive sport player. 32.9% of injured participant practice 2-3 hours per-week, 29.4% practice 4-6 hours, 25.9% practice 0-1 hours and 11.8% practice more than 7 hours a week.

Table 3 shows that, 76.5% of patients reported that ACL injury are serious. 81.2% of patients reported that injury was caused by sporting reason. 47.1% had partial tear and 41.2% had complete tear. 48.2% had injury in left knee and 43.5% in right knee. 52.9% reported that it was acute while 47.1% was chronic. Time interval between ACL injury and reconstruction was 6 months in 45.9% of patients and more than 6 months in 32.9%. Interval between ACL reconstructions to return to activities was between 6-8 months in 48.2% and 8-10 months in 28.2%. Only 50.6% of patients returned to their activity level.

Table 2 Physical activity among participants (n=85)

Parameter		No.	%
Exercise regularly (n= 898)	Yes	363	40.4
	No	535	59.6
Activity level	Sporting Sometimes	39	45.9
	A highly competitive sport person	13	15.3
	Well trained and frequently sporting	23	27.1
	Not sporting	10	11.8
Hours per week do you train	0-1 hour	22	25.9
	2-3 hours	28	32.9
	4-6 hours	25	29.4
	More than 7 hours	10	11.8

Table 3 Determinants of ACL injury among participants with ACL history (n= 85)

Parameter		No.	%
ACL injuries are serious	Yes	65	76.5
	No	14	16.5
	Not Sure	6	7.1
Mechanism of ACL tear	Sporting reason	69	81.2
	Not Sporting reason	16	18.8
Type of tear	Partial tear	40	47.1
	Complete tear	35	41.2
	Unknown	10	11.8
Laterality of Injured knee	Left Knee	37	43.5
	Right Knee	41	48.2
	Both	7	8.2
Chronicity of injury	Acute	45	52.9
	Chronic	40	47.1
Type of sport that caused the Injury	Running	7	8.2
	Volleyball	7	8.2
	Strength Exercises	7	8.2
	Cycling	5	5.9
	Other Sport	8	9.4
	Basketball	3	3.5
	Soccer	48	56.5
Time interval between ACL injury and reconstruction	Up to 6 months	39	45.9
	More than 6 months to 1 year	28	32.9
	More than one year to 18 months	11	12.9
	More than 18 months to less than 2 years	7	8.2
Interval between ACL reconstruction to return to activities	More than 12 months	10	11.8
	From 10 months to 12 months	10	11.8
	From 6 months to 8 months	41	48.2
	From 8 months to 10 months	24	28.2
Type of management to treat the injury	Rehabilitation only	33	38.8
	Surgical and rehabilitation	45	52.9
	Other Treatment	7	8.2
Return to fitness level	Yes	43	50.6
	No	42	49.4
Occurrence of meniscus injury	Lateral meniscus	10	11.8

with ACL injury	Medial meniscus	18	21.2
	Medial and lateral meniscus	11	12.9
	None	46	54.1
Occurrence of bone injury with ACL injury	Bone Fracture	19	22.4
	Non	66	77.6

As in Figure 2, the most common type of tear of ACL injury among participants was partial tear (47.1%), (41.2%) was complete tear. The most common Type of sport that caused the Injury among participants was soccer (56.5%), (9.4%) others (Figure 3).

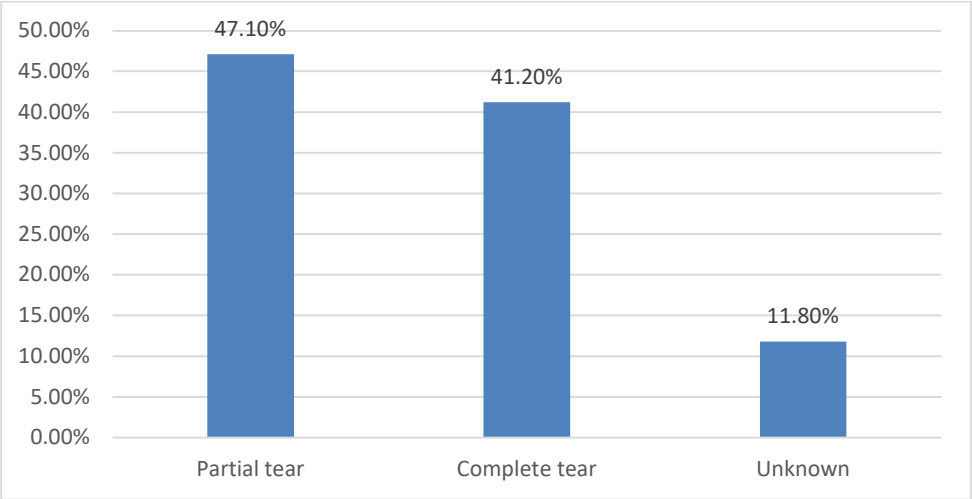

Figure 2 Type of tear of ACL injury among participants

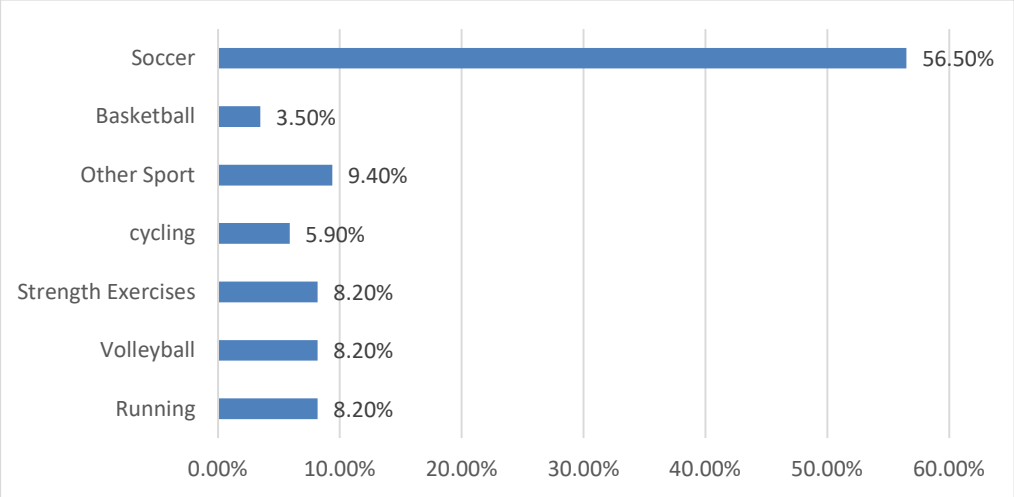

Figure 3 Type of sport that caused the Injury among participants

4. DISCUSSION

ACL injuries are a prevalent concern in sports, causing symptoms such as extreme pain, joint effusion, limited movement, muscular weakness and decreased performance. They are avoidable if athletes are aware of the risk factors that contribute to ACL damage and use preventive strategies. Furthermore, early detection and treatment are critical to enhancing the quality of life of those affected (Alqarni et al., 2022; Ezzat et al., 2021; Mather et al., 2013; Shaker et al., 2019; Waldén et al., 2012). Thus, the purpose of our study to determine whether prevalence of Anterior Cruciate-Ligament-reconstruction has been increased or not in athletic individuals living in Saudi Arabia.

According to our study results, 9.5% of participants have experienced ACL injury before. ACL injury was cited by 14.7% of the players in a prior Saudi study, with no gender difference (Alqarni et al., 2022). Other studies in Saudi Arabia (10.3%) (Shaker et al., 2019) and India (13.5%) (Kumar et al., 2014) have shown comparable results. However, greater rates were recorded in investigations

conducted locally in Riyadh (23.2%) (Almaawi et al., 2020) and the United Kingdom (31.8%) (Ibeachu et al., 2019). Furthermore, the current study's prevalence rate falls within the global prevalence range of 10 to 25%, as documented by a comprehensive review published by Louw et al., (2008), which included 19 researches. A study conducted among students at Umm Al-Qura University's Physical Education College found a prevalence rate of 5.3% (Alghamdi et al., 2017). Other research has found that females are more prone to ACL injury (Agel et al., 2005; Hootman et al., 2007; Prodromos et al., 2007).

Professional athletes in the United States who underwent ACL reconstruction successfully returned to play at a mean of 1 year after surgery; however, the return-to-play rate was only 50% of the 3.5% who had recurrent ACL ruptures needing revision surgery (Brophy et al., 2012). Okoroha et al., (2017) published a study of National-Football-League (NFL) players who had revision ACL repair between 2007 and 2014. They discovered that of the 24 players who underwent surgery, 19 returned to regular-season NFL action an average of one year later. Those who returned to the NFL following surgery played in much fewer games and seasons than before their recurring injury (Okoroha et al., 2017). Lefevre et al., (2017) evaluated return to sport following primary and revision ACL surgery using data from the prospective French ACL Study (FAST). At one-year, functional ratings in the main reconstruction group were considerably higher than in the revision reconstruction group. The rate of return to sport was comparable between the two groups; however, individuals who underwent revision ACL reconstruction were considerably less likely to return to their prior sport than those who had original ACL repair. A prior study conducted among athletes aged 15 to 40 years found that the majority of participants (88.1%) indicated a history of normal sports practice and the degree of physical activity was high among 57.1%. However, nearly half (49.6%) of them reported doing fewer than 5 hours of sports per week (Gans et al., 2018). Another Saudi study conducted among college students aged 18 to 25 in Riyadh found that more-than 1/2 of the participants-engage in sports for 1 hour or less per week (Kamath et al., 2014). The discrepancy between the two studies appears to be due to the nature of the subjects (athletes versus college students).

The American-Academy of Ortho-paedic Surgeons recently established appropriate use guidelines for ACL injury prevention programs, saying that a supervised rehabilitation program can benefit in ACL injury prevention for eligible individuals (Vincent and Herman, 2017). Although it has not been researched, it is likely that the deployment of such programs during the 2004-2014 study periods contributed to the lowering trend in the ratio of-recurrent to primary ACL-ruptures found in female athletes compared to male athletes. Further research on athletes who have had prior ACL reconstruction should be conducted to assist understand who may benefit the most from injury prevention programs.

5. CONCLUSION

The rate of ACL injury among Saudi athletes is comparable to the global average. Surgical repair was conducted on a significant number of the injured athletes, primarily in Saudi Arabia. After healing, the majority of the wounded subjects reported returning to sports. However, half of them said that they did not enjoy sports as much before surgery. Health education is required to improve athletes' and the general public's knowledge of risk factors for ACL damage. Preventive interventions for ACL injury should be widely recognized and implemented among athletes in order to reduce the incidence of ACL injury. A wider and more extensive study is necessary to fully comprehend the true situation.

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Author Contributions

The authors confirm contribution to the paper as follows: Study conception and design: Abdulmalik B Albaker, Abdulrahman B Bahkali; Khame Alzahran; data collection: Mohammad M Bassi, Joud A Alhassun, Batool H Alyami, Bader S Alanazi, Zahraa A Alnakhli; draft manuscript preparation: Abdulmalik B Albaker, Abdulrahman B Bahkali, Mohammad M Bassi, Joud A Alhassun, Batool H Alyami, Bader S Alanazi, Zahraa A Alnakhli, Khames Alzahrani. All authors reviewed the results and approved the final version of the manuscript.

Ethical approval

The research proposal was approved by the Regional Research and Ethics committee of college of medicine, Majmaah University, Saudi Arabia with letter number (MUREC-FEB.5/COM-2022/6-1).

Informed consent

Written informed consent was obtained from all individual participants included in the study.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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